(4) Nicoll, W. 1906.—"Notes on Trematode Parasites of the Cockle and Mussel." Ann. Mag. Nat. Hist. (7) xvii. pp. 148–155.
(5) Nicoll, W. 1907.—"Observations on the Trematode Parasites of British Birds." *Ibid.* xx. pp. 245–271.
(6) Odhner, T. 1904.—"Die Trematoden des arktischen Gebietes." Fauna Arctica, iv. pp. 291–372.

5. Contributions to a Study of the Dragonfly Fauna of Borneo.—Part I. The Corduliinæ: The Genus *Amphicnemis*: The Legion Protoneura.

By F. F. Laidlaw, M.A., F.Z.S.

[Received October 17, 1912: Read November 12, 1912.]

(Plate IV.*)

Index.

ANISOPTERA.

Corduliinæ.

The most recent classification of this subfamily is that suggested by Tillyard†. He proposes to arrange the various genera composing it into four groups, as below :—

i. Eucordulina;
ii. Idocordulina;
iii. Macromina;
iv. Synthemina.

Of these groups i., iii., and iv. are on the whole well characterised, the larvæ are moderately well known, and the geographical

* For explanation of the Plate see p. 79.
† Tillyard, Proc. Linn. Soc. N. S. W. 1912, xxxvi. 2, pp. 381–386.

distribution of the genera fits in well with the proposed arrangement. The second group, Idocordulina, however, is not in so satisfactory a condition. The species referred to it are mostly rare, largely tropical in distribution and hence their larval forms are but little known, and the characters of their venation are very diverse. In consequence there is reason to suspect that the group will prove not to be a natural one, although as no criterion is yet available for a better grouping of the genera referred to it, needs must for the present that it be retained in its existing form.

The group Synthemina, being purely an Australian one, does not concern us here.

Of each of the other three Borneo has representatives.

Writing in 1899, Krüger * was able to record only one Corduline for Borneo, and but fourteen for the whole Malay Archipelago.

Martin in his Monograph of the Cordulinæ, in the "Collections Zoologiques du Baron Edm. de Sélys Longchamps, Fasc. xvii." published in 1906, gives a total for the island of seven.

In the present paper, thanks to the amount of material sent to me from the Sarawak Museum by Mr. Moulton, the Curator, I am able to give the following list of species referable to this subfamily :—

Eucordulina :

Hemicordulia assimilis Sélys.

Idocordulina :

Metaphya micans Laidlaw.
Idionyx dohrni borneensis, subsp. n.

Macromina :

Macromia cincta Ramb.
,, *borneensis* Krüger.
,, *gerstaeckeri* Krüger.
,, *cingulata* Ramb.
,, *westwoodi* Sélys.
,, sp. ?
Epophthalmia australis Hagen.
,, *vittigera* Ramb.

One may, with tolerable confidence, predict additions to this list in the future.

Group i. Eucordulina.

1. Hemicordulia assimilis Sélys.

M. Martin has very kindly examined a male of this species for me and determined its identification. It is new to the Bornean

* Krüger, Stettin. Ent. Zeit. 1899, pp. 321–338.

fauna, having hitherto been met with in the Celebes, New Guinea, and the Solomon Islands.

The bulk of the genera referred to the Eucordulina group are massed in the Holarctic and in the Australian regions; with a few species in Extra-tropical S. America, and outliers in the Oriental region, the Seychelles, and Madagascar. On the whole the distribution agrees fairly closely with that of the Coniferæ, and suggests that the two groups must be of approximately equal geological age.

Tillyard * has pointed out that the Australian genera are not to be regarded as more primitive than those of the northern hemisphere but show specialisation along lines of their own. *Somatochlora*, perhaps the most primitive, is bi-polar.

[*Note.*—In defining the Eucordulina, I believe that stress should be laid on the convergence of M_1 and Cu_1 in the front wing as a character especially marking the group. Accordingly I refer to the group all the genera included by Williamson † in his group i., adding to them *Cordulephya* and perhaps *Hesperocordulia*, the latter in deference to Tillyard's views, but I would exclude from it *Oxygastra* and the genera referred by Williamson to his groups ii. and iii.]

Group ii. Idocordulina.

As I have already remarked, I do not look on this group as satisfactorily defined at present. Here I use it to hold those genera which do not, in my opinion, fit into the Eucordulina on the one hand nor yet into the Macromina on the other. These are genera which fall into groups ii., iii., iv., of Williamson's classification. Whether such genera will not ultimately be found to fall into one or more groups of equal value with the Eucordulina and Macromina I cannot now conjecture.

2. Metaphya micans Laidlaw ‡. (Pl. IV. figs. 1–3.)

1 ♀. Matang Rd. §, 3.10.10.

Length of hind wing 23 mm., of abdomen 20 mm.

The female is more brilliantly coloured than the male, and is amongst the few Cordulines which have really brightly coloured wings. It agrees closely in proportions and in details of venation with the male.

The membranule is large and uniformly grey. This is also the case with the male. By an error I described it as having the upper third of the membranule white, the lower part dark brown. This description should apply to the single cell forming the anal triangle of the male.

* Tillyard, *loc. cit.*
† Williamson, Ent. News, Nov. 1908, pp. 428–434, pl. xviii.
‡ Laidlaw, Sarawak Mus. Journ. No. 2, 1912, pp. 65–67, pl. i.
§ All localities mentioned in this paper are in Sarawak, North-west Borneo.

In the female both pairs of wings have a smoky tinge all over them, most marked towards the apices. Further, the base of the fore wings has a rich red-brown tint, best marked in the submedian space and in the sub-costal space, extending as far as the level of the second antenodal. The base of the hind wing has, too, a darker colour, except along the anal margin beyond the level of the anal angle, but on this wing the colour is for the most part of a dark brownish black (very similar to the colour on the wings of a *Rhyothemis*) with a metallic glaze, except that the median and cubital spaces have only the transparent red-brown tint of the base of the fore wing. The dark colour extends as far as the fourth antenodal nerve, and posteriorly has a regularly curved margin. Body-colour similar to that of the male. Upper surfaces of head and thorax metallic blue-green, abdomen shiny black, under surface of thorax and base of legs dark brown, the rest of the legs black.

The abdomen has been flattened and, especially at its distal extremity, distorted. It does not show quite so distinct an expansion of segments 7, 8, 9 as does the male; none the less there is a distinct enlargement.

The structure of these terminal segments is worth remark. Segment 8 is about $\frac{3}{5}$ the length of 9. Its lateral plates are produced ventrally and posteriorly into a pair of pointed spur-like projections. The lateral plates of 9 have a similar arrangement on a smaller scale.

The ventral plate of 8 is long, produced backwards to the level of the end of 9 at least, its posterior margin running to a median acute angle. It appears to fuse with the ventral plate of 9, which is produced backwards beyond the level of the tip of the abdomen and has exactly the shape of a spoon, with the concavity lying upwards. The ventral plates of both 8 and 9 have a median longitudinal keel. Segment 10 is so much crushed that it is impossible to discuss it. The appendages are small, and reach about to the level of the end of the spoon.

Neither in general organisation nor yet in the structure of the genital appendages does *Metaphya* appear to show particular kinship with *Idionyx*. I figure (Pl. IV. fig. 4) for comparison with the terminal segments of *Metaphya*, an outline drawing of the same part of a female of *Idionyx dohrni* Krüger from the Peninsula of Malacca (Skeat Expedition). The anal appendages of the male *Idionyx* distinctly approximate to the type found in *Macromia*, whilst those of *Metaphya*, which I also figure here, are very different.

I have not been able to examine specimens of the Tropical American *Gomphomacromia paradoxa*. In appearance, judging from Martin's figure *, there are grounds for considering relationship between it and *Metaphya* fairly close. From de Sélys's

* Martin, *op. cit.* pl. ii. fig. 9.

description of the anal appendages, in neither sex do these bear any very marked resemblance to those of *Metaphya*.

The genus *Idionyx*, hitherto unrecorded from Borneo, is represented by a form of *I. dohrni* Krüger, of Sumatra. Other species in all probability await discovery.

3. IDIONYX DOHRNI Krüger, subsp. BORNEENSIS nov.

2 ♂ ♂. Matang, 1905–1907.

Length of hind wing.....	27·5	mm.
,, abdomen	25	,,
,, anal appendages ...	3	,,

Fore wing: antenodals 13, postnodals 6, supratriangulars 1, cross-nerves in median space 1.

Hind wing: antenodals 8, postnodals 9, one supratriangular and two cross-nerves in basal space.

Head: under lip brownish-yellow, upper lip yellow with black margin thickest in the middle line, rest of the front of head black with green and violet metallic shades. Occiput black.

Prothorax black above, dark brownish yellow at the sides.

Thorax metallic green above, with three yellow marks on either side. The first is continued up from the coxæ of the second pair of legs, lying immediately in front of the humeral suture, ending halfway up the suture. The second begins at the coxæ of the hindermost legs and runs up between the wings as a narrow band The third is a rounded mark lying below the base of the hinder wing.

The abdomen is thin and cylindrical, slightly widened at segments 7–9, almost entirely black; the four anterior segments of a shiny texture, the rest dull. Under surface of 2 and 3 yellow.

Wings smoky, with faint yellow tinge at base; membranule small, grey.

Legs: coxæ and base of femurs of first two pairs yellow-brown. Lower third of first pair of tibias, and nearly the whole of second and third pairs, red-brown. The rest very dark brown or black.

Anal appendages a little longer than the last two segments of the abdomen. Upper pair black, lower appendage very dark brown, black at the tip. Seen in profile the upper pair are cylindrical, slightly bowed upwards at their middle, tapering very gradually to the extremity, which ends in a downwardly directed point. The lower appendage slightly overlaps them, and is curved upwards towards its extremity, which carries a minute backwardly directed point.

Seen from above, the upper pair are thick for the first two-fifths of their length, then rather thinner, approximated a little at their middle, then diverging slightly, lastly turning inward again towards their extremities, which have a rounded outline and carry a fine tuft of hairs on their outer sides.

The lower appendage for the first two-fifths of its length is

rather ovoid in shape; at its middle it carries on either side a blunt tooth or spur; the last two-fifths of its course it has nearly parallel sides fringed regularly with fine hairs and its apex blunt in outline.

The 10th abdominal segment carries on its dorsal surface a small, laterally compressed truncate projection.

On the underside of segment 7, at the junction of its middle and distal thirds, is a fine bunch of yellow-brown hairs projecting downwards. This character is perhaps specific, but may occur in the males of other species; I have not seen it noted, and have not been able to examine other specimens *.

I. dohrni borneensis differs from the typical *I. dohrni* from Sumatra chiefly as follows:—

I. dohrni Krüger.	*I. dohrni borneensis.*
i. All the coxæ yellow.	First two pairs of coxæ yellow.
ii. Lower anal appendage not overlapping upper pair.	Lower anal appendage slightly overlapping upper pair.
iii. Yellow markings on abdomen more extensive.	

Group iii. Macromina.

Genus Macromia.

According to Martin, the following species have been recorded from Borneo:—

Macromia cincta Ramb.
,, *borneensis* Krüger.
,, *gerstaeckeri* Krüger.
,, *cingulata* Ramb.
,, *westwoodi* Sélys.

I give a brief description of a very large female specimen, collected by Mr. Moulton, which must probably be referred to an unnamed species.

4. Macromia sp.

A single ♀ taken in October 1911 at Sadong.

Length of hind wing	58·5	mm.
,, abdomen	65	,,
,, pterostigma	3	,,

The specimen is unfortunately badly damaged. It is remarkable on account of its great size, and is most probably unnamed. I prefer to leave it so for the present, in the hope that more material may be forthcoming shortly.

Fore wing: antenodals 17–19, postnodals 10, supratriangulars 4, median cross-nerves 5.

Hind wing: antenodals 11, postnodals 12, supratriangulars 2, median cross-nerves 4.

* See note at the end of this paper.

Wings of a smoky tint, without any basal colour.

Front of head entirely russet-brown, with metallic-green reflex above; occiput black. Prothorax dark brown. Thorax brown with a faint metallic-green reflex, antealar sinus bright brown. The lateral stripe is of a pale brown colour, and is bordered on either side with more richly metallic colouring.

Abdomen entirely bronze-black, except for a square yellow mark on the base of segment 7 occupying not quite a third of the length of the segment. The first four segments have a strong metallic lustre, the rest are duller.

Legs black, slender.

In the present specimen the span of the fully extended fore wings is 125 mm.

5. Macromia cincta Ramb.

1 ♂. Baram.

Length of abdomen 49 mm., of hind wing 45 mm.

This specimen agrees exactly with de Sélys's account of *M. cincta*, save that segments 6 and 7 of the abdomen are entirely black.

[*Note.*—The large female *Macromia* described above has certainly a very close resemblance to *M. westwoodi*, especially in the colouring and in the absence of a basal mark to the wings. De Sélys described *M. westwoodi* ♀ as having "deux large bandes antéhumérales fauves," a description which would scarcely apply to the specimen I have described. It is further very considerably larger, but the range of size in species of this genus is not well known so far as Oriental species go, so that whilst I incline to believe that Mr. Moulton's specimen represents an undescribed species, I feel bound to await further material before describing it.]

M. gerstaeckeri is readily distinguished from other Bornean species by its relatively small size (span about 70 mm. in the male, 80 mm. in the female), by the possession of a narrow yellow antemedial line, incomplete above, and by the position of the external tooth on the upper anal appendages of the male, nearly at the extremities of the appendages instead of being at their middles, as in the other Bornean species so far as is known. Further, it has a yellow band across the nasus. I confess that the position of *M. borneensis* Krüger seems to me a little doubtful, it certainly comes very near *M. cincta*. It is impossible, however, to study these species satisfactorily without the advantages of having a good series before one. *M. cingulata* Ramb., with much yellow on the face and abdomen, is very distinct.

Genus Epophthalmia.

6. Epophthalmia australis Hagen.

I have examined a young male of this species, collected by

Mr. Moulton. The species has been recently discussed by Dr. Ris.

7. Epophthalmia vittigera Ramb.

ZYGOPTERA.

Agrioninæ.

Genus Amphicnemis Sélys.

Certainly one of the most characteristic genera of the Malay province. It has been recorded only from Borneo, Sumatra, and the Philippine Islands. It will ultimately, no doubt, be found to occur in the Malay Peninsula. In its recorded area it is probably represented by very many species.

The genus is notable for several reasons. One of these is the remarkable sculpturing of the hinder lobe of the prothorax found in several species, either in both sexes or in the males alone.

A second, perhaps more remarkable character, is, that whereas males of most of the species at any rate present a very uniform system of colouring of the body, the females, on the other hand, are often more brilliantly coloured than the males, and show, so far as I can judge, a far greater diversity between the species in this respect.

The extreme delicacy of these creatures, and the somewhat bizarre form of the anal appendages of the males, together with the curious prothoracic armature (closely paralleled in the case of *Disparoneura* and some other genera), suggest that the genus is highly specialised and "gerontic": to be compared, perhaps, with *Opisthostoma* amongst the land molluscs, and *Calamaria* amongst the snakes of the same province. No observations are available on the habits or life-history of the species.

The material I have studied consists of six male specimens belonging to five species, and of five females belonging to four species; representing in all, probably, six distinct species.

1. Amphicnemis wallacei Sélys*. (Pl. IV. fig. 7.)

1 ♂. Baram, 15.10.10 (adult).

Length of abdomen..... 32·5 mm. (without appendages).
„ hind wing ... 18·5 „

This specimen agrees closely with de Sélys's description of the type, whilst the anal appendages bear an exact resemblance to those figured by Dr. Ris for a specimen from Sintang.

[The female is said by Dr. Ris† to have the whole thorax, the femora, and tibiæ blood-red, the tarsi yellow, and the spines of the legs dark. The prothorax is without the median spine which occurs in the male sex.]

* De Sélys, Synops. des *Platycnemis*, no. 2, Bull. Acad. Belg. 1863.
† Ris, Ann. Soc. Ent. Belg. lv. 1911, pp. 236–237, figs. 4 & 5.

2. Amphicnemis louisæ, sp. n. (Pl. IV. figs. 5, 5 *a*.)

1 ♂. Baram, Sarawak, 1910 (adult).
1 ♀. Limbang River, 3.4.10 (adult).

♂. Very similar in appearance to *A. wallacei*.

Lower lip dark brown, upper lip dark bronze-green ; the rest of the dorsal surface of the head black, with metallic reflex.

Prothorax : above and at the sides bronze-black ; below whitish. A small spine rises from the middle of the posterior margin, it is hooked vertically upwards, and is about one-half the size of that found in *A. wallacei*. Seen from above, the lateral angles of the posterior margin are produced as a very small pair of outwardly directed spurs.

Thorax : above dark metallic green, below brownish white.

Abdomen : segments 1 and 2 metallic green above, brownish white below. The succeeding segments are of a dull brown colour, becoming progressively darker, their under surfaces paler.

Pterostigmata black, with a very fine grey margin, which is much narrower than in *A. wallacei*. 13 antenodals in the fore wing.

Legs white (first two pairs lost), with articulation between femur and tibia black, a fine black line running along the whole posterior surface of the femur. Tarsus missing.

Anal appendages whitish, lower pair about four-fifths the length of upper pair. The upper pair are curved a little downward, their extremities flattened laterally and folded in on themselves. Each has at its middle a rounded projection directed inwards. Lower pair much as in *A. wallacei*, but ending in an upturned point.

♀. Agrees with the male in the characters of the prothoracic posterior margin. The whole of the prothorax and thorax is of a rich orange-yellow colour, the alar sinuses have dark metallic-green spots, and the prothoracic spine is tipped with the same colour. The legs are blood-red, with black articulations and black spines, the tarsi yellow. Abdomen similar in colour to that of the male, but duller.

The vivid colouring of the female gives it a very striking appearance.

3. Amphicnemis madelenæ, sp. n. (Pl. IV. figs. 6, 6 *a*.)

2 ♂ ♂. Kuching, 11.11.09.

♂ adult. Length of abdomen ..... 32 mm.
,, hind wing ..... 18 ,,

Lower lip yellowish white, upper lip pale yellow, with its base brown, and a median and two lateral minute black spots. Epistome black ; upper surface of head dark green ; basal joints of antennæ pale brown.

Prothorax : upper surface and sides metallic green, under surface pale yellow with slight orange tinge. Posterior margin with a long, median cylindrical horn, nearly vertical, dark at its base, pale towards the extremity, proportionately much longer than in

A. wallacei. Seen from above the lateral angles of the posterior margin are acute, but scarcely produced to form spurs.

Thorax: above metallic green, on the sides a pale pearly green, yellowish white below.

Abdomen with segments 1 and 2 metallic green above, yellowish white below; the rest brownish black above, paler below, progressively darker backwards; 9 and 10 uniform very dark brown, almost black. Wings with the *pterostigmata of the hinder pair bright orange*, darker in the centre. Those of front wings dark grey with paler margin. Legs entirely yellowish brown, darker at the articulation, spines dark brown.

Anal appendages white in the younger male, tipped with purple-brown in the more mature specimen.

Upper pair slender, cylindrical, slightly bowed downwards, dilated at the extremities, the dilated part being folded over on itself so that there is a ventral groove or channel. There is also a small blunt internal projection at about the middle of the length of each. Lower pair rather stout, antler-like, a little compressed laterally, each with a strong tine directed inwards and upwards at its middle.

Female unknown.

4. Amphicnemis remiger Laidlaw *.

1 ♂. Batu Lawi.

[I have described this species elsewhere. Here I give its characters very briefly. No prothoracic spine. A small lateral spine to posterior prothoracic margin. Pterostigmata of all four wings grey. Legs primrose-yellow with a black ring at each articulation. Anal appendages white, upper pair slender with a small dorsal tooth at their middles, extremities flattened to form an oval paddle-shaped expansion. Lower pair shorter, slender, ending in a fine upturned point. Female unknown.]

5. Amphicnemis martini Ris †.

1 ♂. Limbang. 1 ♀. Matang Rd., near Kuching.

The male has been compared with the type by Dr. Ris, who has kindly informed me that he can find nothing to distinguish it therefrom, save that whilst in the type the pterostigmata of the hinder wings are of a yellowish white, in Mr. Moulton's specimen they are bright orange.

The posterior prothoracic margin is without projections. The legs are pale orange-yellow with yellow spines and black tibio-femoral articulations. The anal appendages are figured by Dr. Ris. They are missing, together with the last three abdominal segments, in this specimen.

The single female included here has also been examined by

* Journ. Str. Br. Roy. Asiat. Soc. 1912 (paper not yet published).
† Ris, *loc. cit.* pp. 237–238, fig. 6.

Dr. Ris, who believes it to be rightly referred to the present species. He observes that the shape of the posterior prothoracic margin is similar to that of *A. wallacei* ♀, but not identical with it. It is gently convex, with marked lateral angles. The colouring is very different from that of the female *A. wallacei*, and approximates to the colouring of the male. The dorsal surface of the prothorax and thorax is bronze-green, their sides a pale pearly green; under surfaces and legs whitish yellow. There is a complete longitudinal black line on the posterior surfaces of the femurs, black spines, and black articulations. The abdomen has segments 1 and 2 bronze-green above, dull yellow below; the remaining segments are of a dull brown colour, paler below, progressively darker from before backwards.

Length of abdomen 32 mm., of hind wing 20 mm.

The head is too much crushed and shrivelled to permit of any description.

6. Amphicnemis sp.

2 ♀♀. Baram, 14.10.10.

Length of abdomen 33·5 mm., of hind wing 20 mm.

Upper surface of head entirely dark metallic green. Prothorax red-orange, rather paler below; its posterior dorsal margin gently convex, produced on either side into a fine backwardly directed short spur. Thorax with a rather narrow bright metallic-green band, succeeded laterally by blood-red colouring, which fades into a dull orange-red on the under surface; alar sinuses metallic green.

Abdomen: segments 1 and 2 lustrous brown above, each with a terminal metallic-green ring. The rest of the abdomen brown above, pale whitish brown below, darker posteriorly.

Pterostigmata grey-brown with pale margin.

Legs red, tarsi whitish yellow, articular markings black, spines dark brown.

The colouring of these specimens resembles very closely that of *Teinobasis rajah* recently described by me. There can be no doubt that these specimens should be referred to *Amphicnemis* and not to *Teinobasis*. They have been examined by Dr. Ris, who has favoured me with the subjoined remarks on them:—

"I am at a loss to give good characters for separating *Teinobasis* and *Amphicnemis*—this although I believe that the two are quite distinct genera, as proven by the widely different type of ♂ appendages. There is certainly a difference in stature also, *Amphicnemis* being decidedly the more delicate, with especially a very narrow and feebly built thorax. But a good character that would do for both sexes and for all the species is still to be sought for, my material is so very insufficient for such an investigation. I believe the great similarity in colour of the two forms in question (*Amphicnemis* sp. ♀ and *T. rajah*) is merely a case of convergence.'

The following brief characterisation of the known species of *Amphicnemis* may be useful:—

A median posterior prothoracic spine present in both sexes.
- Spine similar in both sexes; upper surface of thorax of female without metallic colouring. *A. louisæ*, sp. n. Borneo.
- Spine in female longer than in the male; thorax above with golden bronze marking. *A. gracilis** Krüger. Sumatra.

Prothoracic spine in male only.
- Large species (abdomen ♂ 45 mm.); thorax of female with metallic band above, and with marked lateral projections to posterior margin of prothorax. *A. lestoides* Brauer†. Mindanao.
- Smaller species (abdomen ♂ 36 mm.); thorax of female entirely blood-red. *A. wallacei* Sélys. Borneo.

No prothoracic spine in males.
- Pterostigmata of hind wings orange-yellow in male; colouring of female similar to that of male, also without prothoracic spine; small species (abdomen ♀ 32 mm.). *A. martini* Ris. Borneo.
- Pterostigmata of hind wings of male grey or black; small species (♂ abdomen 34 mm.), ♀ unknown. *A. remiger* Laidlaw. Borneo.
- Pterostigmata of hind wings of male grey; large species (♂ abdomen 41 mm.); female coloured very much like the male. No prothoracic projections. *A. ecornuta* Sélys‡. Sumatra.

Lastly, *A. furcata* Brauer§ from Luzon has no median spine but a lateral pair in the male, whilst the pterostigmata are all black; *A. madelenæ*, sp. n., from Borneo, has the pterostigmata of the hind wings orange-yellow, and a long cylindrical median prothoracic spine in the male; in both species the female is unknown.

Legion **PROTONEURA.**

Genus Disparoneura Sélys, Ris emend.‖

Lower lip with short rounded lobes; pterostigma rhomboidal or lozenge-shaped; lower section of triangle present as a vestige or absent. No supplementary basal postcostal nerve. Basal postcostal lying *between the level* of the antenodal nerves.

The genus so defined ranges from the Cape of Good Hope through Tropical Africa to India, Ceylon, Burmah, and the Malay Peninsula and Great Malay Islands. It appears to show advancing specialisation from west to east both as regards colour and venation characters, reaching its maximum in Borneo, east of which island its occurrence is doubtful. [Two species described by de Sélys as belonging to the genus *Alloneura*, from the Philippine Islands, were subsequently referred to *Disparoneura* by him, but as in his description no special reference is made to the position of the basal postcostal nerve, which is the character used here to distinguish the two genera, and as I have not been able to examine examples of these two species, their exact position I

* Krüger, Stett. Ent. Zeit. 1898, pp. 121-123.
† Brauer, Verh. zool.-botan. Gesell. Wien, 1868.
‡ De Sélys, Ann. del Mus. Civ. di Genova (2) vii. 1889. Krüger, *loc. cit.*
§ Brauer, *loc. cit.*
‖ See note at the end of this paper.

treat as doubtful. They are *Disparoneura*? *integra* Sélys, and *Disparoneura*? *obsoleta* Sélys.]

Further east the genus is replaced by the closely allied *Caconeura* (*Alloneura*), which in regard to venation is still further specialised.

Like many other genera which are richly developed in the Malayan region, it appears to be but poorly represented in Java. The Malayan species appear to fall into three groups characterised by the coloration of the males.

One of these groups, possibly the most primitive, has the males black with yellow markings on the head and thorax. A second is that in which the males show blue markings on a black ground.

In the third group the males are black, with carmine, brick-red, and orange-coloured markings.

The females of all these groups appear to be very similar as regards colouring; they are black, with dull yellow or orange markings. They are, however, remarkable in the possession of various curious developments of the margin of the prothorax.

The grouping of the species according to the colouring of the male is suggested by Förster*, who regards certain forms with black and red males as races or subspecies of *D. verticalis*. I have here extended the limits of his "*verticalis* section" to include all the black and red Malayan species with no lower sector of the quadrilateral, or with only a trace of it. I think it unnecessary to treat these species as mere subspecies of *verticalis*; I believe them to be well characterised and readily recognisable species.

I propose to group them as follows:—

A. Head of the male with a red band passing from eye to eye, across the ocelli.

1. ♂. Anterior surface of thorax orange-red, upper lip black, anal appendages red-brown.
   ♀. Head black with orange band passing from eye to eye; prothorax black with lateral orange lines, the posterior margin deeply lobed (échancré) at its middle. Thorax black, with three yellow bands on either side. *D. dorsalis* Sélys. Borneo.

2. ♂. Upper lip red; broad red bands on front of thorax.
   ♀. Head black with yellow band from eye to eye; prothorax black with livid-red lateral lines, its posterior margin carries on either side a strongly curved point. Thorax black, with three yellow or livid-brown lines on either side. *D. verticalis* Sélys. Borneo.

3. ♂. Small red antehumeral lines on the anterior surface of the thorax; prothorax with a large red spot on either side.
   ♀. Head with complete yellow band from eye to eye; prothorax with large red spot on either side. Posterior margin? Small red humeral band on prothorax, and two yellow lateral ones on either side. *D. delia* Karsch. Sumatra. Java (Förster).

(None of the males of *D. dorsalis* that I have examined has any trace of a lower sector of the quadrilateral. In *D. verticalis* this is at least usually present.)

* Förster, Fascic. Malay., Zool. pt. iv. Odonata, pt. ii. p. 14.

B. Upper surface of the head of the male entirely black.

[1. ♂. Upper lip pale yellow, prothorax entirely black; no antehumeral band on thorax, two yellow lateral stripes on either side. Segments 3–7 of the abdomen carmine-red above, anal appendages yellow above.

♀. Unknown.

D. hyperythra Sélys. Borneo.]

2. ♂. Genæ of a bright yellow colour, head otherwise entirely black. Prothorax with lateral carmine spots. Thorax with a fairly broad antehumeral carmine band, a brick-red succeeded by an orange line on either side of the thorax. Abdomen with carmine-red on segments 1 and 2 above.

♀. Unknown.

D. hosei, sp. n. Borneo.

3. ♂. Head entirely black, prothorax with small lateral carmine spots. A fine carmine antehumeral stripe on thorax, with lateral brick-red and orange lines; abdomen entirely black.

♀. Head with yellow band from eye to eye. Prothorax with a small pair of lateral bosses on the median lobe, the posterior margin produced backwards into a flat rounded median collar.

D. humeralis Sélys. Malacca; Java.

3*a*. ♂. Antehumeral line absent, prothorax all black.

D. humeralis, var. *nigra* Förster. Pahang.

4. ♂. Head entirely black, prothorax entirely carmine above. Abdomen with segments 1, 2, 3 carmine above.

(?) ♀. Head with very narrow incomplete line passing from eye to eye; lateral ends of posterior margin of prothorax produced to form two large forwardly directed horns (cf. *D. verticalis*).

D. peramœna, sp. n. Borneo.

The presence of a lower sector of the quadrilateral appears to be fairly constant in *D. humeralis*, and perhaps generally absent in the other species.

Of the group which includes males with blue and black markings, Borneo possesses the following species:—

D. interrupta Sélys,
D. collaris Sélys,
D. lansbergi Sélys (?);

whilst *D. moultoni* Laidlaw and *D. gracillima* Sélys perhaps represent a third group, with yellow markings on a black ground. *D. moultoni* shows, I believe, some relationship to *D. hyperythra*, and may be a melanotic species allied to it, and not primitive.

Lastly, *D. aurantiaca* Sélys is a handsome Bornean species with the anterior surface of the thorax bright orange, and plentiful orange markings on the abdomen in the male, which is very distinct in its venation and colouring from other members of the genus found in the island. The posterior margin of the prothorax of the female carries subtriangular, strongly recurved, plate-like extensions.

Description of new species.

Disparoneura peramœna, sp. n. (Pl. IV. figs. 8, 8*a*.)

2 ♂ ♂, 2 ♀ ♀. Lawas and Limbang, Aug., Sept., 1909.

Length of abdomen: ♂ 29·5 mm.

,, hind wing: ♂ 16 mm.

No trace of lower sector of quadrilateral. Upper sector of quadrilateral of fore wing extending to the first cross-nerve after the quadrilateral in all the specimens. In the hind wing variable, ranging from the nodal cross-vein to that immediately beyond it.

Postnodals of fore wing 14–15.

♂. Head entirely black, including the lower surface.

Prothorax: above of a rich carmine, anterior and posterior lobes delimited by a fine transverse black line. Sides and under surface black.

Thorax black; in front a pair of carmine bands, slightly crescentic, extending for about two-thirds of its length from its anterior margin, succeeded at the top of the thorax by a minute carmine spot. Antealar sinuses of the same colour. Anterior lateral thoracic band of a brick-red colour, the posterior, on the metepimeron, yellow.

Legs black, coxæ and a ring round the base of the femora brown.

Abdomen black, segments 1 and 2 carmine above; 3 has at its base above a very long narrow carmine triangle with its apex directed backwards, extending for about one-fourth the length of the segment.

Anal appendages black, dark brown at their bases.

The upper pair seen from the side have their posterior margin rather crescentic, with an inwardly directed spur on the lower side. Lower pair with the posterior margin S-shaped, the terminal hook rather more slender than in most species of the genus.

♀. Head black, upper lip yellow; a very fine yellow mark runs inward from each eye to the ocelli, but does not form a complete band.

Prothorax black; median lobe with a pair of round lateral yellow spots, anterior lobe with a very small lateral yellow mark. The median lobe is almost hemispherical. The posterior margin is produced on either side so as to form a curious horn-like projection directed upwards and then forwards.

The thorax is black. There is a fine yellow antehumeral stripe incomplete above, extending about one-third the length of the upper surface. There is a well-marked yellow lateral band, and behind this the yellowish grey of the under surface shows at the side of the metepimeron.

Legs brownish black, the anterior surfaces of the femora and tibias yellow.

Abdomen dull brown, paler beneath, with a small subterminal pale ring on segments 3–6; the last three segments almost entirely black.

The male is characterised especially by the colour of the head and prothorax; the female appears to approach that of *D. verticalis*, but differs in details of coloration. I believe I have correctly referred the females described above to this species, but as was the case with that described by de Sélys for *D. verticalis*, the evidence is not conclusive.

DISPARONEURA HOSEI, sp. n.

1 ♂. Baram, Borneo.

Length of abdomen ..... 32 mm.
„ hind wing ..... 18 „

Fourteen postnodal costals on the fore wing.

Head entirely black above and below, save for a fine yellow mark on the genæ. Prothorax black above, with a small carmine spot on each side of the three lobes on either side; yellow markings underneath about the articulations of the limbs.

Thorax black, with a rather broad complete pair of antehumeral bands of a rich carmine colour, a median lateral pair with an orange tone, and a sharply defined posterior pair yellow in colour. Ventrally the thorax is black, save for yellow points at the articulation of the limbs, as in the prothorax.

Abdomen black; segment 1 has a small transverse, terminal, carmine band dorsally, 2 is entirely carmine above, 3 has a fine carmine line above running nearly the whole length of the segment, tapering to a very fine point posteriorly.

Legs black, the femurs have a yellow ring at their bases, best marked on the posterior pair.

The abdominal appendages are black, the upper pair seen in profile are about equal to the lower pair; these latter in profile appear blunt, but seen from above they end each in an incurved hook, as do those of allied species.

This species is very near *D. humeralis* from Malacca. It is characterised by the yellow genæ, the broad carmine antehumeral bands, and the red markings on the first three abdominal segments.

The single specimen was received some years ago from Mr. Hose along with other material from Baram.

Genus PROTOSTICTA Sélys.

PROTOSTICTA VERSICOLOR, sp. n.

1 ♀. Lawas, 15.9.09 (27·6).

Length of abdomen 27 mm., of hind wing 19 mm.

Fifteen antenodal nerves in fore wing. Basal postcostal nerve lies at a level widely proximal to that of the first antenodal costal nerve. A second postcostal nerve, probably representing a trace of the lower sector of the quadrilateral, lies at a level just proximal to the second antenodal costal. Pterostigma trapezoid, covering more than one cell. Upper sector of triangle reaching some distance beyond the nodus in fore wings.

Head bronze-black, upper lip greyish white, lower lip brown.

Prothorax and thorax chocolate-coloured above and on the sides, with a metallic lustre. Under surfaces pitch-black.

The prothorax is provided with a remarkable spine resembling very closely that found in certain species of the genus *Amphicnemis*. It rises from the middle of the posterior margin and is

about 1 mm. in length. It projects upwards with a slight forward curving.

The abdomen is very slender. Segment 9 longer than 8. Segments 1–8 of a dull brown colour growing darker from before backwards, each of the segments 2–8 with a pale narrow ring at either end, 9–10 of a chocolate bronze-colour. The legs are dull yellow, with dark articulations and cilia.

I cannot at the moment recall any other Malayan Agrionid which has the under surface of the thorax actually darker than the upper side. This peculiar colouring of the thorax, together with the pale yellow legs, gives this insect a very striking appearance. It is further distinguished from other species of the genus, which is new to Borneo, by the prothoracic spine.

Genus Platysticta Sélys.

Platysticta rufostigma Sélys. (Pl. IV. fig. 9.)

1 ♂. Lawas, August 1909. (No. 34.)

Length of abdomen ..... 34 mm.
„ hind wing ..... 22 „

The specimen agrees in every particular, excepting size, with the type from Labuan. The latter is distinctly smaller, whilst Mr. Moulton's specimen approaches *P. quadrata* in size. The anal appendages further resemble those of the type of *P. rufostigma*, and differ completely from that figured by me for *P. quadrata* *.

I am thus able to record 13 species referable to the legion 'Protoneura,' arranged in three genera, for the island of Borneo.

EXPLANATION OF PLATE IV.

Fig. 1. Ventral view of terminal segments of abdomen of *Metaphya micans* Laidlaw. ♀.
2. Lateral view of second abdominal segment of *Metaphya micans* Laidlaw. ♂.
3. Lateral view of anal appendages of the same.
4. Terminal segments of *Idionyx dohrni* Krüger ♀, for comparison with fig. 1.
† 5. Profile view of prothorax of *Amphicnemis louisæ*, sp. n. ♂.
5*a*. „ „ anal appendages of the same.
6. „ „ prothorax of *A. madelenæ*, sp. n. ♂.
6*a*. Lateral view of anal appendages of the same.
7. Profile view of prothorax of *A. wallacei* Sélys.
8. „ „ „ *Disparoneura peramœna*, sp. n. ♀ (anterior end to the right).
8*a*. Similar view of male anal appendages of the same species.
9. Lateral view of anal appendages of *Platysticta rufostigma* Sélys. ♂.

Note.—Since the above notes were written I have received from Dr. Ris copies of two accounts recently published by him dealing with Dragonflies from the Orient. The first of these (Supplementa Entomologica, Deutsch. Ent. Mus. No. 1, Aug. 1912,

* Laidlaw & Förster, in Fascic. Malay., Zool. pt. iv. Odonata, pt. ii. p. 9, fig. 1.

† The profile figures are drawn on one plane, and, in consequence, the lateral angles are not shown.

pp. 44–84, Taf. iii.–v.), discusses new Dragonflies from Formosa, South China, Tonkin and the Philippine Islands. Amongst others, two species of the genus *Idionyx* are described as new. In the case of one of these, *I. claudia* Ris, from Tsa-Yin-San, the male carries on the under side of segment 7 of the abdomen a brush of hairs exactly similar to that which I have described as occurring in *I. dohrni borneensis*. Dr. Ris figures this feature in his paper (*loc. cit.* p. 83, fig. 18). The second paper (Tijdschrift voor Entomologie, Deel lv. 1912, pp. 158–182, pls. 6, 7, 8) contains an account of Odonata from Java and Krakatau. The characters of the genus *Disparoneura* and *Caconeura* are discussed, and a specimen of *D. humeralis* from Mula (Java) is recorded.

6. On the Structure of Bone in Fishes: a Contribution to Palæohistology. By Edwin S. Goodrich, M.A., F.R.S., F.Z.S., Fellow of Merton College, Oxford.

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(Text-figures 13–16.)

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In a paper on the Scales of Fishes, published in the 'Proceedings' of this Society five years ago (1), I showed that the so-called "Ganoid" scales are of two kinds, differing fundamentally in minute structure and mode of growth. Scales of the first kind, to which the name Cosmoid was given, are typically covered with an outer layer of cosmine, and grow by the addition of new cosmine at the edge and new layers of bony tissue on the inner surface. The second kind, the true Ganoid scale, grows by the addition of new complete concentric layers, formed of cellless ganoine on the outer surface and bony tissue on the inner surface. Cosmoid scales are found in the Dipnoi and Osteolepidoti (extinct Crossopterygii), and in these only. True Ganoid scales occur only in the Actinopterygii and Polypterini (which probably belong to the Actinopterygii, 2). Moreover, it was further shown that the Ganoid scales can also be distinguished into two varieties—the Palæoniscoid and the Lepidosteoid. The former is characterised by the presence of a middle cosmine-like layer, and occurs only in the Chondrostei (Palæoniscidæ and their allies) and in the Polypterini; while the latter variety—the Lepidosteoid scale—is found in the Orders Amioidei (Protospondyli, + Pholidophoridæ, and Oligopleuridæ) and Lepidosteoidei (Lepidosteidæ and Aspidorhynchidæ). The lepidosteoid scale is easily distinguished by the absence of the middle cosmine-like layer and by the presence of a system of delicate tubules running through and at right angles to the bony layers. The tubules have been described by Reissner (5), Hertwig (3), and Nickerson (4)